| Notice of Allowability | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/744,904 | TAKAHASHI ET AL. | |
| | Examiner | Art Unit | |
| | Rip A. Lee | 1713 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *08-23-2007*.

2. ☒ The allowed claim(s) is/are *1, 3, 5-8, 10-20, 22, 24-28, 30-43*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 09-16-2005
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

***Allowable Subject Matter***

Claims 1, 3, 5-8, 10-12 are allowed over the closest references, Malmberg *et al.* (*Macromolecules*, 1998) and Machida *et al.* (U.S. Patent No. 5,747,620).

The claims are drawn to an ethylene homopolymer or ethylene/$C_{4\text{-}20}$ α-olefin copolymer wherein (*i*) the methyl branches are less than 0.1 per 1000 C atoms as measured by $^{13}C$ NMR spectroscopy, (*ii*) the molecular weight distribution, $M_w/M_n$ is 1.8 – 4.5, (*iii*) the intrinsic viscosity, [η] (135 °C, decalin) is 0.2 – 18 dL/g, (*iv*) the number of branches having a length equivalent to that of hexyl or longer is less than 0.1 per 1000 C atoms, and (*v*) the intrinsic viscosity and melt flow rate (2.16 kg, 190 °C) satisfy the relation:

$$[\eta] > 1.85\ MFR^{-0.192} \quad \text{when MFR} < 1$$

$$[\eta] > 1.85\ MFR^{-0.213} \quad \text{when MFR} \geq 1$$

Malmberg *et al.* discloses a polyethylene homopolymer, labeled B5, having a molecular weight distribution of 2.4. The $^{13}C$ NMR spectrum of this polymer, shown in Figure 3, shows that peaks attributed to methyl branching are not present, or that they are below the limits of detection. The number of hexyl branches per 1000 C is less than 0.2. The intrinsic viscosity, although not shown, is a function of weight average molecular weight, and for sample B5 having $M_w$ of 120,000, intrinsic viscosity may be calculated to be 1.79. The polymer would appear to exhibit properties (*i*)-(*iv*) of the instant claims. With respect to property (*v*), Applicant has shown in a declaration under 37 C.F.R. 1.132 that a polymer prepared using the same catalyst and under representative reaction conditions does not exhibit the claimed relationship between intrinsic viscosity and melt flow rate. Applicant has addressed the negligible effect of catalyst/co-catalyst ratio on the rheological properties of the polymer. The preponderance of evidence rests with Applicant, and therefore, one concludes that Malmberg *et al.* does not teach a polymer exhibiting all properties recited in the instant claims, and therefore, the claimed polymer is patentably distinct over that described in the prior art.

Machida *et al.* teaches ethylene/ $C_{3-20}$ α-olefin copolymers having a mole ratio of methyl groups to methylene groups [$CH_3/CH_2$] of 0.005 to 0.1, corresponding to 5 methyl groups per 1000 methylene groups. The molecular weight distribution, $M_w/M_n$, of copolymers lies in the range of 1.5 – 70, and the intrinsic viscosity, [η] (135 °C, decalin) is 0.01 – 20 dL/g. The polymer does not have the requisite branching number of less than 0.1 per 1000 C atoms.

Claims 13-20, 22 and 24-28 are allowed over the closest reference, Yamaguchi *et al.* (JP 10-017617).

The claims are drawn to an ethylene homopolymer or a copolymer of ethylene and a $C_{4-20}$ α-olefin containing less than 0.1 methyl branches per 1000 carbon atoms, a polydispersity, $M_w/M_n$, of 5.5-50, and wherein the decane soluble components ($W$ (% by weight)) at 23 °C and density ($d$ (g/cm$^3$)) satisfy the following relations:

$W < 80 \exp(-100(d - 0.88)) + 0.1$ where MFR $\leq$ 10 g/10 min and

$W < 80\ (\text{MFR} - 9)^{0.26} \exp(-100(d - 0.88)) + 0.1$ where MFR > 10 g/10 min.

Yamaguchi *et al.* discloses an ethylene homopolymer having a polydispersity of 46 with no methyl branching and no branches due to hexyl or longer branches. The reference does not teach polymers exhibiting the recited relationship between $W$ and density.

Claims 30-33 are allowed over the closest reference, Morimoto *et al.* (U.S. Patent No. 5,260,384).

The claims are drawn to an ethylene (co)polymer having: (*i*) a melt tension and swell ratio defined by the inequality log(MT) > 12.9-7.15SR, (*ii*) a relationship between intrinsic viscosity [η] and melt flow rate defined as:

$$[\eta] > 1.85\ \text{MFR}^{-0.192} \quad \text{when MFR} < 1$$

$$[\eta] > 1.85\ \text{MFR}^{-0.213} \quad \text{when MFR} \geq 1$$

and (*iii*) a relationship between weight average molecular weight and swell ratio expressed as SR > 4.55 – 0.56log ($M_w$).

Morimoto *et al.* discloses a polyethylene which displays a melt tension of 70, a swell ratio of 1.9, an intrinsic viscosity of 4.71 and MFR of 2.9. Both conditions (*i*) and (*ii*) are satisfied, however, the patent does not teach polymers having the recited relationship between $M_w$ and swell ratio.

Claims 34-38 are allowed over the closest references, Kojoh *et al.* (U.S. Patent No. 5,731,393), Brant (U.S. Patent No. 6,294,631), and JP 8-302083.

The claims are drawn to an ethylene homopolymer or a copolymer of ethylene and a $C_{3-20}$ α-olefin having a molecular weight distribution greater than 9.2 and the ratio $M_z/M_w$ defined by the expression, $M_z/M_w \geq 4/ (0.5 - 4.50/ ((M_w/M_n) - 0.2))$.

None of the polymers in the cited patents meets the claimed limitation of $M_z/M_w$.

Claims 39-43 are allowed over references cited to date. The claims are drawn to an ethylene homopolymer or a copolymer of ethylene and a $C_{3-20}$ α-olefin having at least two maxima and at least one minimum in the GPC molecular weight distribution curve in which the intensity of the minimum value ($W_1$) and the lower intensity of the maximum values having the minimum value between them ($W_2$), satisfy the inequality $W_1/W_2 < 0.85$.

The subject matter of these claims is not taught or fairly suggested in the cited references.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rip A. Lee whose telephone number is (571)272-1104. The examiner can be reached on Monday through Friday from 9:00 AM - 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reached at (571)272-1114. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on the access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

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September 24, 2007

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